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CLAIMS

1. An image compression device, comprising:
an encoding part that performs a frequency
5 analysis of image data, encodes a plurality of
coefficients generated by the frequency analysis first
unit by first unit, and generates a plurality of codes;
a code reduction part that reduces the amount
of the codes of each of the first units; and
10 a processing part that further divides the
coefficients or the codes in each of the first units into
a plurality of second units, and increases the amount of
code reduction in the code reduction part for each of the
second units according to values of the coefficients of
15 each of the second units or according to values of the
codes of each of the second units.

2. The image compression device as claimed in
claim 1, wherein:
20 the code reduction part comprises:
a truncation table including a plurality of
truncation data sets to each of which a data number is
assigned, said truncation data sets determining the
amount of the codes to be truncated from the codes
25 corresponding to one of the coefficients from the least

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significant bit of the codes in each of the first units,
said truncation data sets being arranged so that along
with an increase of the data number, the amount of the
codes to be truncated increases or decreases gradually,
5 and the image quality degrades or improves gradually; and
a rate controller that determines one of the
data numbers corresponding to one of the truncation data
sets, said one of the truncation data sets resulting in a
change of the amount of the codes of each of the first
10 units after code truncation in accordance with the one of
the truncation data sets to be close to a target value.

3. The image compression device as claimed in
claim 1, performing coding in compliance with the JPEG
15 2000 standards, wherein:

the encoding part performs a two-dimensional
discrete wavelet transformation on the image data and
generates a plurality of wavelet coefficients, divides
the wavelet coefficients into a plurality of sub-bands,
20 performs arithmetic coding for the wavelet coefficients
of each of the sub-bands and generates a plurality of
codes;

the code reduction part reduces the amount of
the codes by truncating a portion of the codes
25 corresponding to one of the wavelet coefficients from the

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least significant bit of the codes in each of the sub-bands; and

the processing part divides each of the sub-bands into a plurality of code blocks, and increases the amount of codes to be truncated in the code reduction part for each of the code blocks according to values of the wavelet coefficients in each of the code blocks or according to values of data obtained by processing the wavelet coefficients of each of the code blocks.

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4. The image compression device as claimed in claim 3, wherein:

the processing part comprises:

an average value calculation circuit that
15 calculates an average value of the wavelet coefficients of a plurality of effective pixels in each of the code blocks, or an average value of the data obtained by processing the wavelet coefficients of the effective pixels in each of the code blocks; and

20 a masking coefficient calculation circuit that determines the increase of the amount of the codes to be truncated in each of the code blocks performed in the code reduction part according to the average value obtained in the average value calculation circuit.

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5. The image compression device as claimed in claim 4, wherein:

the average value calculation circuit quantizes the wavelet coefficients of the effective pixels in each of the code blocks, and calculates the average value of the data obtained by quantizing the wavelet coefficients.

6. The image compression device as claimed in claim 4, wherein:

the average value calculation circuit encodes the wavelet coefficients of the effective pixels in each of the code blocks by the arithmetic coding, and calculates the average value of the data obtained by encoding the wavelet coefficients.

7. An image compression method, comprising:
a first step of performing a frequency analysis on image data, encoding a plurality of coefficients obtained by the frequency analysis first unit by first unit, and generating a plurality of codes;
a second step of reducing the amount of the codes of each of the first units; and
a third step of further dividing the coefficients or the codes of each of the first units into

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a plurality of second units, and increasing the amount of code reduction for each of the second units according to values of the coefficients of each of the second units or according to values of the codes of each of the second
5 units.

8. The image compression method as claimed in claim 7, wherein:

the second step comprises:

10 a step of creating a truncation table including a plurality of truncation data sets to each of which a data number is assigned; said truncation data sets determining the amount of the codes to be truncated from the codes corresponding to one of the coefficients
15 from the least significant bit of the codes in each of the first units, said truncation data sets being arranged so that along with an increase of the data number, the amount of the codes to be truncated increases or decreases gradually, and the image quality degrades or
20 improves gradually; and

a step of determining one of the data numbers corresponding to one of the truncation data sets, said one of the truncation data sets resulting in a change of the amount of the codes of each of the first units after
25 code truncation in accordance with the one of the

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truncation data sets to be close to a target value.

9. The image compression method as claimed in claim 7, performing coding in compliance with the JPEG
5 2000 standards, wherein:

the first step comprises a step of performing a two-dimensional discrete wavelet transformation on the image data and generating a plurality of wavelet coefficients, dividing the wavelet coefficients into a
10 plurality of sub-bands, performing arithmetic coding for the wavelet coefficients of each of the sub-bands and generating a plurality of codes;

the second step comprises a step of reducing the amount of the codes by truncating a portion of the
15 codes corresponding to one of the wavelet coefficients from the least significant bit of the codes in each of the sub-bands; and

the third step comprises a step of dividing each of the sub-bands into a plurality of code blocks,
20 and increasing the amount of codes to be truncated in the code reduction part for each of the code blocks according to values of the wavelet coefficients in each of the code blocks or according to values of data obtained by processing the wavelet coefficients of each of the code
25 blocks.

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10. The image compression method as claimed in claim 9, wherein:

the third step comprises:

a fourth step of calculating an average value
5 of the wavelet coefficients of a plurality of effective
pixels in each of the code blocks, or an average value of
the data obtained by processing the wavelet coefficients
of the effective pixels in each of the code blocks; and
a fifth step of determining the increase of
10 the amount of the codes to be truncated in each of the
code blocks performed in the code reduction part,
according to the average value obtained in the average
value calculation circuit.

15 11. The image compression method as claimed in
claim 10, wherein:

the fourth step comprises a step of quantizing
the wavelet coefficients of the effective pixels in each
of the code blocks, and calculating the average value of
20 the data obtained by quantizing the wavelet coefficients.

12. The image compression method as claimed in
claim 10, wherein:

the fourth step comprises a step of encoding
25 the wavelet coefficients of the effective pixels in each

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of the code blocks by the arithmetic coding, and calculating the average value of the data obtained by encoding the wavelet coefficients.

5 13. A program for compressing image data, comprising instructions for causing a computer to execute:

 a first step of performing a frequency analysis on the image data, encoding a plurality of
10 coefficients obtained by the frequency analysis first unit by first unit, and generating a plurality of codes;

 a second step of reducing the amount of the codes of each of the first units; and

 a third step of further dividing the
15 coefficients or the codes of each of the first units into a plurality of second units, and increasing the amount of code reduction for each of the second units according to values of the coefficients of each of the second units or according to values of the codes of each of the second
20 units.

 14. The program as claimed in claim 13, wherein:

 the second step comprises:
25 a step of creating a truncation table

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including a plurality of truncation data sets to each of which a data number is assigned, said truncation data sets determining the amount of the codes to be truncated from the codes corresponding to one of the coefficients
5 from the least significant bit of the codes in each of the first units, said truncation data sets being arranged so that along with an increase of the data number, the amount of the codes to be truncated increases or decreases gradually, and the image quality degrades or
10 improves gradually; and

a step of determining one of the data numbers corresponding to one of the truncation data sets, said one of the truncation data sets resulting in a change of the amount of the codes of each of the first units after
15 code truncation in accordance with the one of the truncation data sets to be close to a target value.

15. The program as claimed in claim 13, said program performing image compression in compliance with
20 the JPEG 2000 standards, wherein:

the first step comprises a step of performing a two-dimensional discrete wavelet transformation on the image data and generating a plurality of wavelet coefficients, dividing the wavelet coefficients into a
25 plurality of sub-bands, performing arithmetic coding for

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the wavelet coefficients of each of the sub-bands and generating a plurality of codes;

the second step comprises a step of reducing the amount of the codes by truncating a portion of the codes corresponding to one of the wavelet coefficients from the least significant bit of the codes in each of the sub-bands; and

the third step comprises a step of dividing each of the sub-bands into a plurality of code blocks, and increasing the amount of codes to be truncated in the code reduction part for each of the code blocks according to values of the wavelet coefficients in each of the code blocks or according to values of data obtained by processing the wavelet coefficients of each of the code blocks.

16. The program as claimed in claim 15, wherein:

the third step comprises:

a fourth step of calculating an average value of the wavelet coefficients of a plurality of effective pixels in each of the code blocks, or an average value of the data obtained by processing the wavelet coefficients of the effective pixels in each of the code blocks; and a fifth step of determining the increase of

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the amount of the codes to be truncated in each of the code blocks performed in the code reduction part according to the average value obtained in the average value calculation circuit.

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17. The program as claimed in claim 16,
wherein:

the fourth step comprises a step of quantizing the wavelet coefficients of the effective pixels in each
10 of the code blocks, and calculating the average value of the data obtained by quantizing the wavelet coefficients.

18. The program as claimed in claim 16,
wherein:

15 the fourth step further comprises a step of encoding the wavelet coefficients of the effective pixels in each of the code blocks by the arithmetic coding, and calculating the average value of the data obtained by encoding the wavelet coefficients.

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19. A storage medium that stores a program for compressing image data and comprising instructions for causing a computer to execute:

a first step of performing a frequency
25 analysis on the image data, encoding a plurality of

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coefficients obtained by the frequency analysis first unit by first unit, and generating a plurality of codes;

a second step of reducing the amount of the codes of each of the first units; and

5 a third step of further dividing the coefficients or the codes of each of the first units into a plurality of second units, and increasing the amount of code reduction for each of the second units according to values of the coefficients of each of the second units or
10 according to values of the codes of each of the second units.

20. The storage medium as claimed in claim 19, wherein:

15 in said program,
the second step comprises:

a step of creating a truncation table including a plurality of truncation data sets to each of which a data number is assigned, said truncation data
20 sets determining the amount of the codes to be truncated from the codes corresponding to one of the coefficients from the least significant bit of the codes in each of the first units, said truncation data sets being arranged so that along with an increase of the data number, the
25 amount of the codes to be truncated increases or

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decreases gradually, and the image quality degrades or improves gradually; and

a step of determining one of the data numbers corresponding to one of the truncation data sets, said
5 one of the truncation data sets resulting in a change of the amount of the codes of each of the first units after code truncation in accordance with the one of the truncation data sets to be close to a target value.

10 21. The storage medium as claimed in claim 19, wherein:

the image compression is performed in compliance with the JPEG 2000 standards, wherein:

the first step comprises a step of performing
15 a two-dimensional discrete wavelet transformation on the image data and generating a plurality of wavelet coefficients, dividing the wavelet coefficients into a plurality of sub-bands, performing arithmetic coding for the wavelet coefficients of each of the sub-bands and
20 generating a plurality of codes;

the second step comprises a step of reducing the amount of the codes by truncating a portion of the codes corresponding to one of the wavelet coefficients from the least significant bit of the codes in each of
25 the sub-bands; and

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the third step comprises a step of dividing each of the sub-bands into a plurality of code blocks, and increasing the amount of codes to be truncated in the code reduction part for each of the code blocks according to values of the wavelet coefficients in each of the code blocks or according to values of data obtained by processing the wavelet coefficients of each of the code blocks.

22. The storage medium as claimed in claim 21, wherein:

in said program:

the third step comprises:

a fourth step of calculating an average value of the wavelet coefficients of a plurality of effective pixels in each of the code blocks, or an average value of the data obtained by processing the wavelet coefficients of the effective pixels in each of the code blocks; and

a fifth step of determining the increase of the amount of the codes to be truncated in each of the code blocks performed in the code reduction part according to the average value obtained in the average value calculation circuit.

23. The storage medium as claimed in claim 22,

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wherein:

in said program:

the fourth step comprises a step of quantizing
the wavelet coefficients of the effective pixels in each
5 of the code blocks, and calculating the average value of
the data obtained by quantizing the wavelet coefficients.

24. The storage medium as claimed in claim 16,
wherein:

10 in said program:

the fourth step further comprises a step of
encoding the wavelet coefficients of the effective pixels
in each of the code blocks by the arithmetic coding, and
calculating the average value of the data obtained by
15 encoding the wavelet coefficients.